From: Hopi Utility Corporation,
United States Environmental Protection Agency – Region 9, and
United States Indian Health Service/Eastern Arizona District Office

To: United States Department of Agriculture – Rural Development Program Arizona State Office

Subject: Hopi Arsenic Mitigation Project - Preliminary Engineering Report (PER) Review No. 2 dated 13 June 2017

Date: 1 September 2017

On 13 June 2017, Mr. Mike Luecker P.E., of the United States Department of Agriculture – Rural Development Program (USDA-RD), Arizona State Office completed an eleven (11) page review and written comment response to the Preliminary Engineering Report (PER) for the Hopi Arsenic Mitigation Project (HAMP). Mr. Luecker's response document was provided to Ms. Loretta Orona, USDA-RD CP Specialist in Show Low AZ, who subsequently forwarded the document to Mr. Timothy Bodell of the Hopi Utility Corporation. Mr. Bodell has since shared the USDA-RD's written comment responses with the Indian Health Service/Eastern Arizona District Office (IHS/EADO) and with the United States Environmental Protection Agency-Region 9 (USEPA-R9).

The 2014 HAMP PER was produced as a requisite submittal for project funding applications to the USDA-RD program. LCDR Adam Hughes, P.E. of the IHS had sealed the PER on 26 August 2014. The HAMP-PER was provided to the USDA-RD by the Hopi Tribe for preliminary review on 3 February 2016.

The following information is intended to reply specifically to the HAMP-PER questions and responses which were generated by the USDA-RD as a part of the written record to its HAMP-PER review process. Numbered heading titles that replicate the titles and sequence of order which are presented in the 13 June 2017 USDA-RD PER document preface each of the response comment sections to that document and are provided herein.

1. Overall comment: (***joint-agency response***) It is agreed that wellhead treatment for the removal of Arsenic (As) is technically feasible. One could also state that the long-term provision of bottled water to address oral consumptive needs is technically feasible, but not very practical. Through the Hopi Utility Corporation (HUC), which is a wholly-owned tribal

enterprise, the Hopi Tribe formally supports a regional water system plan to serve the First and Second Mesa Villages which must currently utilize water that is pumped from groundwater wells that are contaminated with As. Those wells produce water that exceeds the federal Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) of 10 parts per billion (ppb) as As.

The Hopi Tribe has assessed its options with respect to SDWA As-MCL compliance. Two (2) wells that produce high quality, As-MCL compliant water have already been constructed in the Hopi Reservation Turquoise Trail area near Hard Rock. Those wells are dedicated to the purpose of providing safe drinking water to First and Second Mesa Villages with no regulatory treatment requirements and no loan-service debt obligation.

The Hopi Tribe has deliberately chosen to not request funding assistance to serve its villages on an interim replacement-period basis with multiple well-head As-treatment facilities. It is known that fully and properly maintained As treatment systems will not provide service beyond a 15-20 year useful life-span. Thus, the motivation to invest in relatively short-lived As treatment equipment cannot be preferred when at least 25% of that equipment cost would be repaid over a 40-year loan period as has been proposed.

2. Section 3.0, Project Planning Area:

   a. BIA Arsenic Treatment Systems: (***joint-agency response***) An updated MOA that does not include BIA/BIE will replace the Draft MOU in Appendix E of the PER. BIA/BIE have not signed the planning agreement to evaluate their inclusion. The PER design section does not include the additional flows that the BIA/BIE systems would create.

   b. Keams Canyon: (***USEPA-R9 response***)

   SDWA COMPLIANCE FOR HOPI WATER SYSTEMS WITH ARSENIC TREATMENT

   BIA Keams Canyons PWS

   The BIA Keams Canyon Agency operates an AdEdge adsorptive media arsenic removal plant. Prior to filter vessels, raw water is injected with CO_2 gas to lower the pH from 9.0 to 7.0-7.8. Sodium hypochlorite solution is then injected for disinfection and oxidation of the dissolved arsenic. Post-treatment pH adjustment was not included in the design. The treatment plant came online in April 2012. The treatment plant design capacity is 150 gallons per minute (gpm). The average daily demand is estimated to be 62,500 gpd. The filter vessels are backwashed every sixty days and they recycle the backwash back through the plant (see sanitary survey report).

Arsenic Rule *- BIA Keams Canyon PWS has been in compliance with EPA's arsenic standard since the 4th quarter of 2012. They test monthly for influent and effluent levels of arsenic at their treatment plant. While they have maintained compliance on a running annual average basis, they have experienced multiple instances where their individual monthly samples have exceeded EPA's arsenic standard of 10 parts per billion (ppb) since startup of the treatment plant.*

Arsenic rule compliance samples are required to be taken at the entry point to the distribution system (i.e. after treatment but before the first customer). However, EPA has received sample results that were taken in the distribution system after start-up (Building 59 on 9/3/2013) that show arsenic levels (57 ppb) that were greater than raw water concentration (30 ppb) which may be indicative of arsenic leaching from the distribution system pipes.

Lead and Copper Rule *- Since the installation of the arsenic treatment system which includes pre-treatment pH adjustment but no post-treatment raising of the pH, the BIA Keams Canyon system experienced a sampling event on 6/17/2015 where they exceeded EPA's action level for lead in the distribution system (16 ppb Lead). Lowering the historical pH of the water increases its corrosivity which may contribute to increased lead levels in the distribution system.*

Monitoring, Reporting Violations *– In 2016 and 2013 they received monitoring violations related to the lead and copper rule. They have since returned to compliance.*

Operator Certification- The operator certification requirements for this plant require a water operator to be certified at a Treatment Level 2 certification. Their current operator, Scott Walker has a distribution level certification but does not hold a treatment level certification.

Second Mesa Day School-

Arsenic Rule *- Second Mesa Day School first commissioned its Isolux arsenic treatment system on June 5, 2007. The first quarter they came into compliance with EPA's standard was the fourth quarter of 2008. Since that time, they have again violated the arsenic rule in the following quarters: 2Q2017, 1Q2017, 4Q2016, 3Q2013, 2Q2013, 1Q2013, 4Q2012. Their current running annual average for the 2nd quarter of 2017 was 13.6 parts per billion.*

Monitoring, Reporting and Public Notice Violations *- They have received numerous M+R violations since 2007 for failure to monitor for arsenic, other inorganics, total coliform, disinfection by-products, nitrate, VOCs, SOCs and radionuclides. They've also received violations (2 in 2013) for failure to post public notices for MCL violations relating to their arsenic exceedances.*

Operator Certification *- They do not currently employ a certified operator. The operator certification requirements for this plant require a water operator to be certified at a Treatment Level 2 certification. The raw water has a high level of vanadium which may necessitate having to replace the Isolux cartridges on a more regular basis and the water system's pattern of intermittent compliance with the arsenic standard.*

Hopi Junior-Senior High School

Arsenic Rule *- Hopi High School has operated its reverse osmosis plant since 1998. It's unclear when they installed the KDF cartridge filters which likely remove arsenic. They were out of compliance for an extended period between 2007 and 2010 and subject to an enforcement order. More recently they received violations for arsenic MCL exceedances from January 2016 through March 2017 (5 quarterly violations). Their most recent running annual average is 9.6 ppb*

Lead and Copper Rule *– In 2011, the Hopi High School system experienced a sampling event on 8/02/2011 where they exceeded EPA's action level for lead in the distribution system (18 ppb Lead).*

Monitoring, Reporting and Public Notice Violations *- They have received numerous M+R violations in the last ten years for failure to monitor for arsenic, other inorganics, lead and copper, total coliform, disinfection by-products, nitrate, VOCs, and radionuclides. They've also received violations (in 2015 and 2016) for failure to post public notices for MCL violations relating to their arsenic exceedances.*

Operator Certification *–The operator certification requirements for this plant require a water operator to be certified at a Treatment Level 2, Distribution Level 1 certification. The current operator is certified at a Treatment Level 1 with no distribution certification.*

Existing Operator Certification Levels at 4 HAMP Village Systems:

Water System	***Highest Level Treatment Certification***	***Highest Level Distribution Certification***
Polacca	*None*	*None*
Sipaulovi	*Treatment Level 1*	*Distribution Level 1*
Mishongnovi	*Treatment Level 1*	*Distribution Level 1*
Shungopavi	*none*	*Distribution Level 1*

3. Section 3.4, Community Engagement: (***joint-agency response***) Residential water and sewer rates in Hopi's First and Second Mesa Villages have risen since 2014, but remain artificially low at an average fee of $28.66 per month. The Village of Shungopavi intends to begin the transition to a usage-based metered rate structure when the HAMP Regional Water System becomes their water source. Sipaulovi has already implemented a metered

rate for the lower village(s). Regional water rates are noticeably higher than the current $28.66 average for First and Second Mesa Hopi Villages. The following table presents regional water and wastewater utility fees based on a "typical" monthly usage volume of 7,500-gallons.

Hopi Region Local Utility Rates as of August 2017

Community/Utility	Rate Structure Type	Rates			Monthly fee for 7500 gals.
Globe	Metered	SEWER: Flat $22.35, plus $9.90/month (base for water), plus $0.342/100 gals up to 4k, plus 0.369/100 gals. for 4k-25k, plus $0.463/100 gals. for >25k-			$58.85
Whiteriver	Flat	$31.80/month for W&S. Sewer will soon be 10% extra. TUA is in the process of transitioning to metered rate for water with sewer fee at 10% extra.			$31.80
Holbrook	Metered	WATER: $6.50/month base fee, plus Nov. – June: $1.75/1000 gal. July – Oct.: $1.55/1000 gal. SEWER: $12.00/month base fee, plus $1.75/1000 gal.			$44.75
Winslow	Metered	SEWER: Flat $22.35, plus WATER: $13.66/month meter fee, plus $2.56/1000 gals for 0 – 15k gals. $3.08/1000 gals for 15k – 20k gals. plus $5.13/1000 gals. >20k			$55.21
Shungopavi	Flat	$20/month – Utility is planning to implement a metered rate when HAMP service commences.			20.00
FMCV	Flat	412 residential @25/mo. 4 residential (faucet/hydrant only) @ $15/month 19 business at $65/month Elementary school at $500/month HHCC – metered @ $8.50/1000 gallons (~112k gals. /mo.)			$25.00
Sipaulovi	Metered	$15/month/1000 gal., then $4/1000 $10/month for community hydrant access with a key			$41.00
Upper Village of Moenkopi	Metered	$5.00 (base for W&S), plus $8.15/1000 gals up to 6000 gals., plus $10.50/1000 gals. >6000 gals., plus $8.00/1000 gals x 90% water volume			$123.65
Kykotsmovi	Currently Flat	$15/month for W&S since 04/16. In process of installing meters and implementing a metered rate.			$15.00
Keams Canyon	Flat and Metered	Flat:	Water	Sewer	
		1-bedroom -	$21.90	$21.90	$43.80
		2-bedroom -	$28.00	$27.00	$55.00
		3-bedroom -	$37.50	$33.75	$71.25
		4 or more -	$48.00	$40.00	$88.00
		Metered ($/1000 gals.):			
		1 – 3k gal.	$7.30	$7.30	
		3k – 5k gal.	$5.60	$5.40	$45.10
		5k – 7.5k gal.	$4.80	$4.00	
Spider Mound / Tuba City / Cameron / Dilkon / Ganado / NTUA	Metered	$9.89/month (base for W&S), plus $3.91/1000 gals up to 3000 gals., plus $6.05/1000 gals. >3000 gals.			$48.85
Show Low	Metered	WATER - $28.68/month (base fee includes 5000 gals.), plus $2.82/1000 gals >5000, plus SEWER - $30.81/month			$86.54

HAMP discussions and updates have occurred regularly at Hopi Tribal Council meetings and local Village Council meetings by Hopi Water Resources Program staff and also by the Hopi Public Utility Authority (now HUC) Director. Several large-venue public outreach meetings have also been conducted featuring USEPA and IHS involvement to inform and discuss HAMP-issues with Hopi residents. One such meeting was held at the Hopi Veteran's Center on 5 September 2012. Subsequent well-attended public information meetings were also held at the First Mesa Elementary School and the Second Mesa Day School on 10 and 11 September 2014 respectively.

Informative PowerPoint presentations were delivered at each meeting to share as much information as possible regarding HAMP infrastructure locations and future projected utility fees for participant village utility systems. Printed-copies and CD-ROM copies of the Hopi Water System Strategic Plan (which includes HAMP-service rate projections) were distributed to all village utilities and councils as well as to each relevant administrative division of the Hopi Tribe including the Hopi Water Resources Program and the Hopi Tribe Environmental Protection Agency. Participant sign-up sheets were utilized at each meeting to document attendance. In addition, mailer-style comment questionnaires were distributed to all "signed-in" meeting attendees as a means to encourage responses in the form of comments and/or questions. Only a very limited number of mailed-back responses were ever received, however.

Because local village utility monthly fees have increased, it is possible that the combined net HAMP-customer monthly residential water and sewer fee will be higher than the $67 average as is listed in the August 2014 HAMP Strategic Plan. However, since 2014 the estimated cost of the remaining HAMP construction budget has been reduced by the application of Hopi Tribe, USEPA and IHS funding. Those funds are providing critical HAMP infrastructure needs such as the extension of electrical power to the Turquoise Trail wells, the construction of a new glass-lined steel WST in west Pollacca and the extension of necessary water transmission/distribution piping in Shungopavi. With a reduced remaining project construction budget to be secured, there will also be a reduced 40-year loan component associated with USDA-RD funding assistance. To that end, at least one of the major cost items that contribute to monthly water service fees at the village-system level, i.e. a future loan repayment obligation, has been gradually reduced since 2014.

4. Section 4.0, Existing Facilities: (***joint-agency response***) The federal interagency preliminary engineering report template states "describe the present condition; suitability for

continued use; adequacy of current facilities; and their conveyance, treatment, storage, and disposal capabilities". In response to the USDA request for an existing facilities condition description to be given, the IHS assumes that the general condition of existing facilities is adequate, but also under-funded on a monthly basis to support proper long-term preventive maintenance planning. The existing facilities are just adequate to convey, store, and dispose of potable water. The major and common system inadequacy is noncompliance with the SDWA MCL for As. System deficiencies, which may be discovered in the future, can be addressed through the IHS Sanitation Deficiency System (SDS) on a prioritized health deficiency basis just as the IHS is organized to address other identified sanitation deficiencies in Indian Country.

The stated "adequate" condition of existing facilities is an assumed condition based on the current per household water use that was provided in the 2013 PER and which was based on data from First and Second Mesa village well meters. It is seen that water use per connection per day in Shungopavi, Sipaulovi/Mishongnovi, and the FMCV averages approximately 182 gallons per equivalent dwelling unit per day (gal/edu/day). See revised Table 5.2 below.

[EMBED Word.Picture.8]

Current usage is nearly the same according to the 2015 and 2016 sanitary surveys. This 2013 PER demand includes all water that is lost throughout the system, which is typically about 10%. The EDU-usage value of 182 gpd is unusually low compared to the average water use across Arizona. Water systems with higher than normal water leakage would be assumed to exhibit water-usage levels to statewide average values, but that is not the case for the First and Second Mesa Hopi Villages.

a. Existing Waterlines (Distribution): Per reasons stated above regarding current water usage it can be assumed that current leakage in the system is minimal.

b. Water Meters: Under its funded projects, the IHS provides a water meter to each home that is connected to a village water system. Thus, existing meters on village systems tend to be of various ages. However, oftentimes HUD homes will all have meters of the same age. Some connections may not have meters for reasons that are unknown to the IHS. Data of this type has not been compiled in the 2014 PER because the federal inter-agency PER template does not specifically request that level of detail for an existing water system. In addition, the lack of water meters at some connections does not affect a system's capacity to serve homes with potable water that complies with minimal SDWA requirements. Serving those homes in the First and Second Mesa Hopi Villages

is the stated purpose of the HAMP regional water system planning effort and the basis of regulatory enforcement actions taken to date by the USEPA-R9.

Village utility organizations prefer having the capability to meter residential consumption and charge their customers based on water usage. That policy is slowly being implemented throughout the region as is evidenced by Sipaulovi and the Upper Village of Moenkopi. Shungopavi and Kykotsmovi are also preparing to soon implement metered rate structures.

c. Service Lines: See Existing Waterlines.

d. Wells: Several critical system deficiencies were noted in the latest 2015 and 2016 SDWA Hopi water system Sanitary Surveys including inadequate source-water redundancy in the FMCV. When the HAMP PER was produced, FMCV well no. 6 was in use and well no. 5 was out of service. Today, well no. 5 is in use, and well no. 6 is out of service. According to the 2016 Sanitary Survey by Sleeping Giant Environmental Consultants, LLP, when the well no. 6 pump failed, the pump and drop pipe were removed and never replaced. The use of well no. 5 currently meets EPA standards, but well no. 6 should be re-equipped and placed on stand-by for system redundancy.

e. Section 4.2, Shungopavi: Neither the USEPA-R9, the Hopi Tribe nor the IHS have obtained information on the yield of Shungopavi's "new well" which was drilled in 2008. However, complete water quality results from 2008 were obtained which show that, in addition to high arsenic levels of 33 ppb, the well water contains an elevated gross alpha concentration of 23.98 picocuries per liter (pCi/L). That value exceeds the EPA primary MCL of 15pCi/L for gross alpha. In addition, the pH value of 9.94 standard pH-units exceeded the SDWA secondary MCL of 8.5 pH-units and was higher than any other well which is currently being utilized by any of the First or Second Mesa water systems.

A best available technology (BAT) based plan for gross alpha reduction would need to be implemented in order to utilize the "new well" in Shungopavi. EPA's website recommends blending or other non-treatment options before utilization of BAT treatment options for gross alpha reduction. Any treatment option proposal for the Shungopavi "new well" water source will thus require a treatment scheme for arsenic as well as for gross alpha. Options that include the collection of particles emitting gross alpha (a treatment by-product from filtration processes) must also be evaluated from a waste disposal perspective under any proposed treatment option.

The Hopi Tribe, the HUC, the USEPA-R9 and the IHS have each endorsed the regional water system concept as presented and described in the 2014 HAMP PER. Thus, the need for a treatment alternative which can effectively address SDWA gross alpha MCL exceedance with additional expense and technical complexity to the village utility, in a Shungopavi well which already contains As in excess of 3-times the MCL, is seen as further justification for the non-treatment HAMP regional water system plan.

As provided, the existing facility map has been revised to show the location of Shungopavi's "new well" and the existing 49-year old well. An updated drawing package for the HAMP is also presented for further clarification.

The IHS would like to correct information which is presented on Map SHUNG Sheet 1 of 1 as shown in Appendix B of the HAMP PER. That map states "*existing well to be put into service, minimum 55 GPM needed, backup generator*". For the sake of clarification, this note was meant to say "*a new well will be drilled to replace the existing well, minimum 55 GPM needed, backup generator*". The Appendix B map also states "*Existing Shungopavi Well*". This notation was meant to read "*new well drilled in 2008*". Please see the new HAMP Drawings, Sheets Nos. 5 and 23, which have been provided with this document for further clarification.

These wells are also referenced in Section 6.2.5.3 where it states "*The Shungopavi water treatment facility would be sited next to the re-drilled existing Shungopavi well and the existing water storage tank*". By way of clarification, the future re-drilled Shungopavi well is not located next to the water storage tank. For purposes of this treatment alternative evaluation, the re-drilled Shungopavi well was intended to be drilled next to the existing well located approximately 5000 ft to the south. The transmission main would then begin at that southward location and carry water to the treatment facility located near the tank site and near the "new well" that was drilled in 2008.

f. Section 4.7, Financial Status of Existing Facilities: As allowed, the HUC will compile and provide available information in a separate submittal to the RD Specialist. Current utility fee structure information for each of the First and Second Mesa Hopi Village water systems is presented on Page 4 of this document.

5. Section 5.0, Need for Project: (***joint-agency response***)

   a. Section 5.1: As requested, this section can be renamed to "Health, Sanitation and Security" per current PER guidelines.

b. Section 5.2; As requested, this section can be renamed to "Aging Infrastructure". The priority need and justification for the HAMP is to protect public health by providing SDWA compliant drinking water to the First and Second Mesa Hopi Villages. The joint agency intent is to resolve that issue first and then to address future needs through the IHS-SDS or with funds provided by the Village and Hopi Tribe utility organizations.

In response to comments requesting elaboration on system components please note that the Interagency PER template states a need to describe the concerns of the aging infrastructure and identify those with the greatest impact. The template also mentions a need to describe management adequacy.

i. Water Meters: Shungopavi has recently installed enough water meters to expand from 40% to 80% of its homes now being served with water through meters. Approximately 50 homes still lack meters.

The Sipaulovi Water Association, which provides water services to Lower and Upper Sipualovi/Mishongnovi, bills many of its customers based on a metered rate, though some Mishongnovi residents still pay nothing for their water. Almost all of the homes in the Lower Villages are metered.

The HAMP regional Water System will include a master meter at the system-entry supply point of each village/community water system. In most instances, the master meter will feed directly into the village WST. The HUC will bill each village/community water system based on water volume supplied through its master meter. Village utilities will then bill their local customers based on their own preference of billing formulae. Each village utility will need to meet the expense of its monthly water purchase from the HUC as well as the continued cost of operating its own distribution system. Each utility will choose between utilizing a fixed (flat) rate or a metered rate to fund its utility service operations.

Village utilities that charge their residents by metered water volume will be encouraged to develop an asset inventory plan to assist themselves with upgrading, replacing, or installing meters in their community.

ii. Service Lines: Some water service lines may be built of old and outdated materials such as multi-jointed Schedule 40 PVC. However, and based on known water usage volumes, old service line deficiencies are not currently a highest-priority concern.

iii. Waterlines and System Modeling: Some waterlines may be built of outdated materials such as asbestos-cement pipe. However, and based on known water usage volumes, old piping is not currently a highest-priority concern.

System modeling of existing systems does not appear to be a requirement for discussion in the Inter-agency PER template. However, the IHS should, and does, work with utilities to gather information and resolve known high or low pressure problems within village distribution systems. A hydraulic system model was created for the HAMP Regional Water System plan to evaluate performance criteria of all proposed wells, tanks, and transmission mains.

iv. Wells: Each First and Second Mesa Hopi Village well exceeds the SDWA MCL of 10 ppb for As. At 33 ppb, the "new well" in Shungopavi is much higher in As than other regional water wells.

Due to its age of 49+ years, which is beyond a typically expected design life of 40-years, the existing well in Shungopavi will need to be replaced at some point within the fairly foreseeable future. Of critical importance will be the eventual failure mode of the well. A sudden catastrophic failure, such as column collapse or screen-rupture, would be a difficult and expensive situation for the Shungopavi village utility to address in a timely manner.

The Lower Sipaulovi/Mishongnovi well is almost 40-years old and will soon exceed its expected useful design life. Thus, that well has a limited period of useful life remaining.

The Upper Sipaulovi/Mishongnovi well is also 40-years old. The well produces a sparse 7-9 gpm and the well has a limited period of useful life remaining.

There is no guarantee that newly-drilled replacement wells will provide sufficient yields, or meet basic water quality standards, to serve as suitable community water sources. However, regional data indicates that additional wells in the First and Second Mesa region of the Hopi Reservation should be expected to produce water that exceeds the SDWA MCL of 10 ppb for As.

FMCV wells #5 and #6 are only spaced about 800 ft apart. Currently only well #6 is in operation. Well #5 had a pump go out that has not been replaced.

c. Section 5.3: Will rename section to 'Reasonable Growth' per current PER guidelines.

d. Section 5.3.1, Water Use Trends: Correction in Table 5.2 (See revised Table 5.2 below)– Shungopavi Number of Residential Services is 310 not 146, therefore, the EDU is 92 GPD not 195 GPD. Also, change Estimated Per Capita Usage (GPCD) to 22 from 48. Estimated Equivalent Domestic Unit (EDU) Monthly Usage (Gal/Mo) is 2,796 not 5,938.

Revised Table 5.2 - Estimated EDU and Per Capita Water Usage Corrected

	Residential Connections	2013 Reported Annual Production (gallons)	Estimated EDU Monthly Usage	EDU Daily Usage	Estimated Persons per Home (2010 Census)	Estimated Per Capita Usage (GPCD)	No. of EDU
Shungopavi	310	10,402,600	2,796	92	4.1	22	310
Sipaulovi Mishongovi (lower)	100	7,142,300	5,952	196	3.9	50	100
Sipaulovi Mishongovi (upper)	25	2,102,600	7,009	230	3.9	59	25
FMCV	580	49,953,900	6,788	223	3.6	62	613
Total/Weighted Average		69,601,400	5,533	182	3.8	49	1,048

i. Water Loss: See response to comment 4. Usage is already remarkably low. Therefore, it can be assumed that water loss is an average or less than average amount.

ii. Per Capita Increase in Usage & 50% Assumption: The difficulty of demonstrating a future per capita increase in usage encourages omitting that assumption from future village demand projections. However, and judging by 2013 well meter usage data, the current highly efficient use of water in Shungopavi is likely to result in a future 50% usage increase, especially as more homes transition from the use of outside yard-hydrants as their domestic water source to internal house plumbing. Thus, the IHS recommends that an assumed 50% increase in per capita water usage should remain in the HAMP PER. Please refer to comment response no. 4 (page 5) as further justification.

Without reliable data, RUS Bulletin 1780-2 recommends 67 GPCD or 167 GPD per EDU as a predictor of water usage and demand. Usage data which has been gathered from village utility personnel should be reliable, but the fallback numbers that the USDA suggests for use when reliable data is not available are noted. For that reason, perhaps the HAMP planning effort should utilize the RUS fallback

demand values in lieu of the actual because the actual are seen to be so low. Accepting 67 GPCD as being more realistic would amount to a 32% increase for the 49 GPCD value which is shown in revised table 5.2.

For the benefit of discussion of this response, the 50% usage increase was taken out of the demands of all villages except for Shungopavi in table A in section 6.2. The peak factor demand was also removed. The discussion of how that affects the capital (facilities proposed) and O&M costs can take place by comparing the differences.

- Keams Canyon Improvements: Please reference Section 2.b of this document to see detailed usage and production values from the Keams Canyon arsenic-removal water treatment facility. Keams Canyon's water usage data prior to the installation of its AdEdge As treatment facility is not known but could be useful information if it were available. It is believed that the Keams Canyon water system has historically used more water than is typical for Hopi and Navajo communities. Thus, a significant per capita usage increase since the time that As treatment was initiated on the Keams Canyon water system is not expected. If the Keams Canyon BIA has this information available to share, the usage increase comment can be looked into further.

- Peak Demand: The IHS could further evaluate the impact of omitting peak demand values for HAMP Regional Water System planning and the well-head treatment alternative. Per the IHS Navajo Design Criteria, peak demand is utilized to evaluate minimum pressure values in distribution system piping but not in transmission piping because the flow-rates in those conduits are relatively stable and mostly dependant on fixed well production-rates. However, and in some areas, HAMP regional Water System transmission lines may be tapped to supply residential needs along the pipeline route. The final design evaluation for transmission pipe sizing will thus evaluate the impact of such connections in relation to peak demand considerations based on the number of homes that may be expected to someday tap into the transmission main. The effect of homes tapped into the transmission main should be minor because flows to such homes would be minimal compared to flow in the pipe when a WST calls for water. However, in the final design, the minimum dynamic pressures at the homes and in the transmission main should be checked for the systems at peak demand to see if the pipe size will need to be increased in some areas. WSTs will serve as

buffers for peak flows. As long as the source-wells can provide the average daily usage demand within a 12-hour period, the design is deemed to be proper and sufficient.

Homes which currently have no piped-water supply, but which are located along the proposed HAMP Regional Water System transmission and distribution piping, will benefit from direct piped water connections. This additional benefit to the regional system plan was not discussed in the HAMP PER.

- Sipaulovi: To date, a copy of the Sipaulovi Water Association PER has not been made available for review.

6. Section 6.2 – Treatment Alternative: (***joint-agency response***)

   a. EPA Penalty: IHS can update Section 6.2 of the HAMP PER to better clarify information regarding the BIA fine. See Section 2.b of this document for current compliance information by the Keams Canyon Public Water System.

   b. Complexity: Currently, there are no certified water treatment operators employed by the First and Second Mesa Hopi Village water systems. However, those utility organizations do employ certified distribution system operators. The same is true in Keams Canyon which must rely on AdEdge Corporation technicians to service and trouble-shoot that As-treatment facility on a quarterly and occaisional as-needed basis. At a village level, properly certified water treatment operators (Level II minimum) must be hired and compensated accordingly. In a practical sense, those operators should also reside locally, in the same village as the treatment facility which they operate and oversee. However, that logistical element can present a problem in the Hopi area.

   Bench-scale pilot treatment studies for As-removal have not been conducted at the First and Second Mesa Hopi Villages. That fact is emphasized in consideration of the fact that there are currently four (4) different As-removal technologies being utilized between the Hopi Cultural Center, the Second Mesa Day School, the Hopi High School and the Keams Canyon Water System. Some of those systems require pH adjustment and oxidation, while others do not. One system relies on reverse osmosis and another utilizes proprietary media. While it is preferred to utilize a one-system-fits-all approach to the four or five (4-5) possible well-head treatment sites (Shungopavi, Upper-Sipaulovi/Mishongnovi, Lower Sipaulovi/Mishongnovi, FMCV Well No. 5/6 and FMCV Well No. 8), it is likely that several treatment technologies would be identified as site-

specifically optimal depending on the water characteristics (As, V, Gross Alpha, pH, etc.) of each different source well. Some of the 4-5 treatment facilities will likely be more complex in the layout of their unit-process trains than others.

To date, some feedback from the USDA-RD on these issues has suggested that it may be possible for the HUC to provide certified treatment personnel to operate the village As-removal facilities. However, a significant hallmark of the Hopi Tribal/Viilage relationship is that of independence and autonomy for Hopi Villages, both from the Hopi Tribe and from each other. Each village owns and operates its existing water and wastewater systems with local personnel who are employed by each village utility. It should not be assumed that water treatment operators who are employed by a wholly-owned tribal enterprise, such as the HUC, represent a viable solution to filling an employment position in a local, village-owned, water treatment facility.

While it may seem logical for HUC personnel to operate and maintain As-treatment facilities in each of the First and Second Mesa Hopi Villages, those villages may not be willing to turn the operation of their facilities over to the HUC which could be viewed as a form of Hopi Tribal management. In addition, the HUC was not chartered by the Hopi Tribe for the purpose of operating a well-head As-treatment alternative, it was specifically incorporated to own and operate the HAMP regional water system.

c. Wells: For water-works design standards, the IHS adheres to the 10-States Standards of the Great Lakes Upper Mississippi River Board (GLUMRB) comprised of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, New York, Ohio, Ontario, Pennsylvania and Wisconsin State and Provincial Public Health and Environmental Managers.

Water storage requirements for the well-head treatment alternative shall be based upon the IHS Navajo Area guidelines for systems with multiple sources. That guideline requires 1.5 days of water storage, plus a volume determined by subtracting from one day's storage the volume of water that the remaining water sources can provide in 18 hours if the largest source is out of service. This means that if the largest source is out of service and the remaining sources can meet or exceed the average daily demand in 18 hours, the storage required is 1.5 days. A system with a duplex booster station is considered a multi-source system.

Per the Navajo IHS criteria, more than one water source is not required if the available WST storage is sufficient. Under the IHS Navajo Area Criteria one water source scenario, 3 days of water storage is required. A backup pump must be readily available or more storage may be required. However, the 10 State Standards recommend a

backup source. The only future backup water source well that is included in the 2014 PER treatment alternative is the new Sipaulovi well.

The following tables help to define well capacity needs vs redundancy needs. The 50% increase in consumption (except Shungopavi) was removed from the table for discussion on how capital and O&M costs would change. The 50% peak factor increase was also removed for discussion.

Table A: Additional Capacity Needed for 2038 demand per Navajo Criteria

	2013 Avg Yearly Demand	2014 PER -2013 Avg. Demand, 12 hour	Revised IHS Nav Criteria 2018, 12 hour Avg	Revised IHS Nav Criteria 2038, 12 hour Avg	2038 Avg. Daily Demand (gal)	Existing Well Capacity (gpm)	No. of Existing Wells	Additional Capacity Needed per Navajo Criteria (gpm)
Shungopavi	1E+07	40	65	93	66778	110	2	0
Upper/Lower Sipaulovi/Mishongnovi Combined (1 Treatment Plant)	9E+06	35	38	55	39564	99	1	0
FMCV	5E+07	190	208	297	213782	260	3	37

Table B: Well Purpose Table (Assuming Replacement and Rehab Well Are Similar)

	New Well Needed for Backup per 10 States	Capacity Required for Backup Well	Well Replacement per 2014 PER	Well Rehab per 2014 PER	Wells Recommended to be drilled per 2014 PER	Reason
Shungopavi	0	93	1	0	1	1 for Capacity/Replacement/Backup
Upper/Lower Sipaulovi/Mishongnovi Combined (1 Treatment Plant)	1	55	1	0	2	1 Replacement and 1 for Backup
FMCV	1	147	0	1	1	1 for Capacity/Backup and 1 Rehab

Revised Table 6.4 - Village Treatment Facilities, Minimum Required Capacities			
	Minimum Capacity (GPM)		
FMCV	297		
Sipualovi/Mishongnovi	55		
Shungopavi	93		

Revised Table 6.5 - Additional Village Water Source Capacity Required		
	Needed Yield for Capacity	Needed Yield as Backup
Future FMCV Well	37	147
Future Lower Sipaulovi Well	0	55
Shungopavi Well	0	93

i. Shungopavi Well: (See Section 5.b.iv of this document.) Assume that the 2008 "new well" near the tank can produce 55 gpm. Also assume that the current community water usage value of 22 gpcd will increase to 33 gpcd in addition to a 1.8% growth factor. No peak factor is placed on the demands for discussion purposes. The demands shown are for a 12 hour pumping cycle instead of the 24 hour pumping cycle shown in the PER. Under that scenario, and by 2018, 65 gpm would be required from the well to meet the IHS Navajo Area Criteria of a 12 hour average daily pumping cycle. In 2038, 93 gpm would be required. There are over 100 homes that can potentially be connected to the Shungopavi system. This could add another 21 gpm to the average demand. Two (2) water sources are necessary in Shungopavi from a production standpoint, not just from a redundancy standpoint. The existing well is 49 years old and has therefore exceeded its expected useful life of 40 years. That is why the HAMP PER allows for a new well to be drilled next to the 49 year old existing well in the Village of Shungopavi.

- If information can be found on the capacity of the 'new well' which was drilled in 2008, and if it meets the 93 gpm capacity required, then the need to drill a new well and construct a 5000-ft transmission pipeline could possibly be removed from the well-head treatment alternative cost estimate. That is because there would be more than 3 days of water storage available as long as a backup well-pump is kept in inventory by the utility. However, the 10 State Standards would still recommend that a utility should have two (2) sources of water.
- The "new well" in Shungopavi was found to be higher in As than the other wells and it exceeds the MCL for gross alpha.

ii. Sipaulovi Well: The demands were recalculated for discussion purposes without the 50% increase in water usage or the 50% peak factor increase. The demands given are for a 12 hour cycle instead of the 24 hour cycle given in the PER. In 2018, 38 gpm would be the required source capacity of a combined (Upper/Lower) system. By the year 2038, 55 gpm would be required. The existing Lower Sipualovi well is capable of producing 90 gpm. This well is 40 years of age and there should be a plan to replace it. Under the treatment alternative, there would be a booster station that pumps water up to Upper Sipaulovi WST. Should a new Lower Sipaulovi Well have the capacity to produce a similar quantity of water as its predecessor, then there would be enough excess capacity to supply Upper Sipaulovi without replacing the Upper Sipaulovi Well (39 years old) that only produces 7-9 gpm.

The PER recommends that the existing well be re-drilled. and that a new well be drilled so that there will be two functionally adequate wells under this alternative. A well already exists in the vicinity of the proposed new well shown in the Appendix at the far east side of the map. The well was never connected due to high H2S. In lieu of drilling a 2nd east well in the same vicinity to the well, it may be possible to treat the H2S along with the As at the new well. The amount of water that the well produces in unknown. The USDA comment asks the question whether a new well could be drilled next to the existing well to be utilized as a backup. This can be done as long as the demand does not increase beyond the production of the future well. However, utilizing the existing east well could possibly save one well from being drilled. Either by drilling a new east well or utilizing the existing east well would allow the aquifer to recover periodically near the existing well and create operational advantages in the future when demands increase. Also, Hopi Water Code requires that wells be 1 mile apart, but a waiver may be obtained with a hydrologist's recommendation and tribal concurrence. It remains IHS's recommendation to have a backup source in the Sipaulovi community even after reducing peak demand projections and the 50% usage factor.

At the time of this writing, the BIA has not signed a planning study that would lead to the inclusion of Second Mesa Day School water usage demands into the Sipaulovi planning and design. Table 5.3 showed the demands of the school as 3.4 gpm for a 24 hour pumping cycle in 2013. Therefore, the 12 hour cycle is 6.8 gpm. Without running through the calculations the 2038 demand for a 12 hour cycle might be 10 gpm.

iii. FMCV: The demands were recalculated for discussion purposes without the 50% increase in water usage or the 50% peak factor increase. The demands given are for a 12 hour cycle instead of the 24 hour cycle given in the PER. In 2018, the FMCV would need 208 gpm to meet demands. In 2038, the FMCV would need 297 gpm. According to the 2014 HAMP PER, the combined capacity of the 3 FMCV wells (nos. 5, 6, and 8) is 310 gpm. In 2018, well nos. 5 and 6 will have 8 years of remaining life and well no. 8 should have 20-years of remaining life. A hydrologist may have to recommend an operation to maximize water production from well nos. 5 and 6 because they are within 800-feet of each other. An assumption has been made in the above tables that some hydrological interference occurs between well nos. 5 and 6. Therefore, for these revised calculations, 75 gpm for well no. 5 and 75

gpm for well no. 6 will be assumed and the existing well capacity for FMCV will be reduced down to 260 gpm. It should be assumed that well rehabilitation efforts for well nos. 5 and 6 will also help to produce 75 gpm.

Based on information stated in the 2014 HAMP PER, no wells should need to be drilled for about eight (8) years in the lower FMCV. A well is required on the eastern system for backup and capacity. The drilled well would need to provide a minimum 147 gpm for 12 hours to fulfill these purposes. .

The FMCV cost estimate only recommends drilling one new well while also rehabbing another. This does not appear to be excessive considering that 2 of the FMCV wells are drilled so closely together.

d. System Layout:

i. Shungopavi: See comments under section 5 correcting and clarifying the existing systems configuration in the 2014 PER. There is a new well near the tank site. The PER does not plan another well at this location, rather it is proposed at the existing south well location since that well is about 50 years old and needs replaced. The water quality of the well near the tank may deter a hydrogeologists from recommending to drill in that same location in the future. Therefore, it is recommended to keep the 1 mile of transmission main in the treatment alternative.

ii. Sipaulovi: If your question is whether the "end" of the lower system can be intertied with "existing" 16,000 Upper Sipaulovi Tank, it can. However, no proposed pipe can be eliminated by boosting from another point on the distribution system of lower Sipaulovi instead of boosting from near the Lower Sipaulovi Tank. There are no distribution pipes that are situated any closer. The amount of pipe that could be eliminated by tieing into the existing Upper Tank is 7,900 ft or 1 ½ miles. However, the condition of the structure that houses the 16,000 gallon tank is poor. It may need to be replaced. The proposed 100,000 gallon tank shown in the Appendix would have the benefit of eliminating all or most of the homes on the hydropnuematic system. The tank could be sized similarly to the existing 16,000 gallon tank instead of the 100,000 gallons currently proposed for the treatment alternative if a duplex booster station is provided in Lower Sipaulovi.

iii. FMCV: The suggestion in the USDA comment is to have one treatment plant on the lower system and one on the east system. This suggestion would eliminate 20,800

feet of transmission main, not 5 miles. 20,800 feet of transmission main would cost about $728,000 vs 1 additional arsenic treatment facility costing $498,000. The capital cost savings of $230,000 would be obtained for this alternative, but O&M costs would increase with this alternative by $42,000 per year according to the LCCA Table 3.1.

e. Storage: To facilitate discussion, the 50% peak demand increase has been removed. In addition, the 50% usage increase has been removed from Sipaulovi and the FMCV calculation(s).

Revised Table 6.6 - Additional Water Storage Required, Proposed Village Storage

	Existing Capacity (gal)	2013 Days of Storage	2038 Days of Storage	Storage Req'd to Meet Navajo Guidelines (gal)	Additional Storage Required	Proposed Storage	Formula	Assumption
East Polacca Tank	500000.00							
West Polacca Tank	200000.00	5.2	3.3	415660	0	0	x*1.5 + (x-18*60*110)	Pollacca East holds water for entire system. New well produced more than Well #8.
Upper First Mesa Tank	8000.00							
Shungopavi Tank	250000.00	8.7	3.7	107550	0	0	x*1.5	Both wells produce 55 gpm
Lower Sipualovi Tank	75000.00	3.9	2.5	45850	0	0	x*1.5	Proposed new well is capable of 50 gpm
Upper Sipaulovi/Mishongnovi Tank	16000.00	2.8	1.8	13500	0	0	x*1.5	Booster Station with 2 pumps provides 50 gpm each pump
Upper and Lower Sipualovi/MishongnoviTanks	91000.00	3.6	2.3	59346	0	0	x*1.5	Lower Sipualovi holds water for entire system. Booster Station with 2 pumps provides 50 gpm each pump.

- Sipaulovi Proposed Tank: If the Upper and Lower Villages were connected by a booster station, there would be 91,000-gallons of available storage. If multiple sources (an additional well) will exist on the Sipaulovi system in the year 2038, 59,346-gallons of storage would be needed. Per the IHS Navajo Area Criteria, the combined Upper and Lower systems of Sipaulovi would not require an additional or larger replacement WST, because a booster station would be provided with redundant pump capacity in case one pump should fail. Assuming a backup booster pump at 50 gpm, then 1.5 times the average daily demand is sufficient. 13,500-gallons of storage is required for the Upper Villages and 16,000-gallons of storage already exists.

  An additional benefit to replacing the existing Upper Sipaulovi WST is that it may be placed at a higher elevation to eliminate most homes on the hydropnuematic system. The proposed 100,000-gallon WST could be omitted per the IHS Navajo Area criteria for multiple-sourced systems.

- FMCV Proposed Tank: Under the As-treatment alternative, a new well would be drilled for a total of four (4) wells available as sources. This scenario would require 1.5-days plus 1 day of storage minus the lowest producing wells pumping for 18-hours. The IHS Navajo Area Criteria requires 415,660-gallons of storage for the overall system. The existing 500,000-gallon WST has enough capacity for the overall system. Additional storage of 200,000-gallons is available as excess storage capacity for the lower system. The proposed 200,000-gallon WST could be omitted per the IHS Navajo Area criteria for multiple-sourced systems.
- Alternatively, in the HAMP alternative, the Radio Tower storage tank size could possibly be reduced in size, though a tank is likely still needed as a pressure zone break to keep the pressures reasonable in the transmission main, operational advantages, and to keep the pump sizes in the well head booster station a little smaller.
- In the HAMP alternative, The Shungopavi Tank may not be available to use to store water for Sipaulovi and Mishongovi since the Shungopavi Village owns it. Therefore the proposed Upper Sipaulovi Tank may be needed to provide adequate pressure to the Upper Sipaulovi/Mishongovi homes.

IHS Conclusion to Arsenic Treatment Alternative "Bare Bones" Option

For purposes of discussion, the demands were reduced in the Treatment Alternative to see if some facilities could possibly be eliminated to save costs. In the "Bare Bones" facilities approach, the (2) tanks may be eliminated, maybe one of the Sipualovi Wells (though this would not be a 20 year design), 13000 feet of 6-inch main, and possibly $230,000 in Capital Cost for a second treatment plant in FMCV (though the O&M savings by eliminating this plant and installing pipe would pay for the extra capital in 6 years.) Including fees shown in the cost estimates this may save $2 million in capital costs for the As Treatment option. Table 7.1 shows that the HAMP with Grid Power Option Present Worth Cost is about 6.5 million dollars less than the Arsenic Treatment option. The HAMP alternative would still be better in Present Worth than the Treatment by 4.5 million.

f. Treatment System Design: Four or five (4-5) well-head As removal treatment systems would be needed if individual First and Second Mesa Hopi Villages would elect to pursue

that supply option. Under that scenario, bench-top pilot-testing of As removal technologies should be conducted in each village to determine an optimal treatment strategy for locally-sourced groundwater. Additional design discussions are premature until after any such testing would be concluded.

g. Generators (standby): Depending on assumptions which are made regarding available water storage volumes, the amount of water in storage at the time of a power failure and the duration of a power failure, standby generators and fuel storage reservoirs will be needed to power key supply and treatment system components including the following:

   i. well pumps

   ii. booster station pumps

   iii. As treatment facilities including disinfection equipment

   A previous estimate of $700k to fund multiple units of stand-by power equipment with various kW output ratings is not unreasonable but actual component costs must still be estimated with further specificity if an individual First or Second Mesa Village believes that it should pursue the individual well-head As treatment option. Such an estimate would depend on well-pump and booster-pump HP ratings as well as treatment facility demands which cannot be determined at this time. For example, a high-pressure reverse-osmosis treatment facility may be ideal for a specific water quality but the high-pressure needs of such systems require high horsepower pressure pumps. Other As treatment schemes may be much less energy intensive.

h. Disinfection: Detailed capital costs for groundwater disinfection system equipment should eventually be included as line-item costs for individual arsenic treatment facilities.

i. Planning/design & Sunken Costs: Sunken costs for HAMP alternative planning can be listed and identified on the cost estimate tables as suggested.

j. O&M Costs: The USDA-RD's response to the 2014 HAMP PER references annual O&M costs for previously funded treatment facilities which are significantly lower than the values which have been projected in the Life Cycle Cost Analysis that was developed for the Hopi Tribe by GHD, Inc. and OEM Services.

   The basis of difference between the USDA-RD well head treatment option O&M cost assumptions and those of GHD, Inc. and OEM Services may possibly be that of a "bare bones" approach to maintaining basic As treatment equipment at a level which keeps it running and within warranty specifications and regulatory constraints versus a much

more conservative analysis which intends to address the needs of a potentially more complex treatment facility that must last for a full 20-year design life and possibly beyond due to the assumption of a 40-year debt-repayment obligation. More in-depth evaluation of the O&M cost basis differences is possible, but with appreciable additional effort to be expended. A discussion of how to proceed further with this issue should occur during the next face-to-face meeting with the HAMP regional Water System planning team and the USDA-RD.

Under the well-head treatment option, As contaminated village wells which are still connected to water distribution systems will continue to be sampled for VOCs, SOCs, Nitrate, UCs, etc. on a quarterly, semi-annual and annual basis while continuing to generate monthly power usage bills.

Tabular O&M cost data which was compiled in 2013-14 should now be viewed as approximate values only. Of note is that each of the listed O&M expense items (below) will remain as a regular cost item for each village utility organization under a well-head As treatment alternative plan.

The compiled O&M cost data (below) does not account at all for the effort and expense which is associated with and required for proper operation of As treatment facilities and other water treatment processes.

All data used to compile the HAMP village and school system O&M cost figures was provided by the system managers, village CSAs and system operators. All values are subject to modification pending receipt of more reliable/better documented information.

Customer Name >>	Shungopavi	Sipaulovi - Mishongovi (lower)	Sipaulovi - Mishongovi (upper)	FMCV
Number of Wells in Regular Service	1	1	1	2
Water Pumped From Each Well (gallons/year)	10,402,600	7,142,300	2,102,600	16,711,400
				33,242,500
Total Production Volume (gallons/year)	10,402,600	7,142,300	2,102,600	49,953,900
Rated HP of Pump Motor in Each Well	35	20	5	40
				60
Power Usage in Each Well (kWh/year)	89,901	27,249	15,634	75,064
				178,825
Cost of Power for Each Well ($/year)	$ 13,294.00	$ 4,191.94	$ 2,777.96	$ 15,000
				$ 19,000
Sampling Cost of Each Well ($/year)	$ 2,740.00			
System Sampling Fees for TCR, Pb&Cu, DBPs ($/year)	$ 600.00	$ 3,300.00	$ 1,700.00	$ 512
Utility Vehicle Fuel ($/year)	$ 11,770.00	$ 2,250.00	$ 2,250.00	$ 6,000
Utility Vehicle Maintenance ($/year)	$ 6,388.00	$ 1,000.00	$ 1,000.00	$ 7,000
Water Treatment Chemicals ($/year)	$ 108.00	$ 200.00	$ 80.00	$ 1,700
Burdened Utility Personnel Wages ($/year)	$ 60,786.00	$ 22,000.00	$ 11,000.00	$ 40,568
Utility Administration ($/year)	$ 30,434.00	$ 12,000.00	$ 5,000.00	$ 69,089
Spare Parts & System Repair ($/year)	$ 4,313.00	$ 2,062.00	$ 1,000.00	$ 15,200
Personnel Travel & Training ($/year)	$ 2,483.00	$ 2,266.00	$ 1,000.00	$ 10,000
Utility Board-Member Stipends ($/year)	$ -	$ 755.00	$ 250.00	$ -
Water System R&R Reserve Funding ($/year)	$ 5,000.00	$ -	$ -	$ -
Other Water System Costs ($/year)	$ 3,000.00	$ -	$ -	$ -

k. O&M Support: There are two line items in each of the treatment option cost estimates which total $70k each.

One of the line-items is listed at $40k as "O&M Materials, Equipment and Space". That grouping collectively includes tools for maintaining the treatment system components, spare equipment parts such as valves, chemical pump parts (diaphragms, ball-checks, tubing and ferrules, etc.), and a storage shed/building or other area large enough to house those items.

The other line item is listed at $30k as "O&M Manual Development". This is critical need for village facilities of the type that would be constructed. A complete and thorough manual of the type which should be provided will typically incorporate an extensive manufacturer's cut-sheet file for every item in the facility, a "How To" DVD which explains typical and critical maintenance procedures, and an equipment trouble-shooting guideline for all of the major processes and components in the facility.

l. Replacement and Rehabilitation Costs: A proper response to this comment remains to be formulated by the joint-agency team.

7. Section 6.3 Non-Treatment (HAMP): (***joint-agency response***)

a. Water Rights Compatibililty: Uncertainties exist with the Lower Colorado River water rights negotiations and therefore no consideration in the selection of an alternative will be given to the ease of incorporating the LCR into the design.

b. Section 6.3.3, Findings from Turquoise Wells #2 &3: Reference the follow up report from John Shomaker Associates Inc. titled Projected Long-term Performance of the HAMP Wells 2 and 3. The document is not definitive, but suggests that arsenic concentration should either remain stable or decrease, that TDS may increase, and that the pumping water level should decrease by about 50 feet from 2015 to 2035. Pumping water level would be expected to decrease as pumping continues to increase.

IHS comment: Drilling another well may be preferred to continuing to increase water production after 2035 or much sooner if others such as the BIA/BIE elect to partner on the HAMP water system, thereby increasing demand.

c. Section 6.3.4.2, Selection and Operation of HAMP Disinfection Facilities: N-aquifer water total organic carbon (TOC) is shown to be low in the water quality reports for the HAMP wells. Many Western Navajo NTUA water sources tap into the N-aquifer

including the Hardrock and Pinon wells. Those waters are chlorinated then distributed through many miles of pipelines. Information posted on the NTUA public notification website ([HYPERLINK "http://www.ntua.com/waterno.html"]) shows no disinfection by-product (DBP) MCL violations in the NTUA's N-aquifer water systems. In general, and absent the presence of TOC, DBPs do not generally form in a problematic manner. Upon start-up, well-head chlorine dosages will be fine-tuned as the HUC's operational experience with the HAMP regional water system increases. A general goal should be to maintain a minimal Free Cl-residual of 0.5 mg/l throughout the system. It is possible that re-chlorination may be necessary at a local level if the Keams Canyon BIA/BIE systems will become customers of the HAMP regional water system.

d. Section 6.3.4.5, Services to Villages: The altitude valve is listed in Table 6.8, The FMCV Treatment Cost Estimate.

e. Section 6.3.7, Potential Construction Issues: This project will not be sole sourced to the contractor. NECA will have the opportunity to competitively bid on the project.

f. Section 6.3.8, Sustainability Considerations: The current average utility rates for First and Second Mesa Hopi Villages are $28.66 per month but they are also subsidized to an artificially low level which does not encourage sustainability. The SDWA requirement to provide As MCL-compliant drinking water to First and Second Mesa Villages guarantees that the price of piped potable water will increase. Both the HAMP regional water system plan and the well-head As treatment alternative will necessitate an increase of average monthly service fees.

   The O&M Present Value and the Renewal and Replacement costs equal $8,129,000 for the HAMP alternative and $14,927,000 for the well-head As treatment alternative. Annually the O&M difference is projected to be $430,000 for the HAMP regional Water System as opposed to $765,000 for the well-head As treatment alternative. It would be very difficult to reduce costs of the treatment alternative by $335,000. Note that the costs for the O&M of the treatment alternative were not based on the Peak Demand as shown in Table 3.8 of the LCCA.

g. O&M Support: Yes, O&M support items and the HUC operations center are included within those budgeted line-items (approximate **$395k** total}. This budget will also provide support vehicles for the HUC and other miscellaneous O&M items as are listed in the Strategic Plan.

8. Section 7.0, Selection of an Alternative & Life Cycle Cost Analysis (LCCA):

(***joint-agency response***)

IHS Note: RUS 1780-2 allows flexibility to adjust the planning period from 20 years to any period determined reasonable by the engineer and concurred on by the state or federal agency. This is critical because any extension of the planning period beyond 20-years drives the net present value figures further in favor of the HAMP alternative. It is not at all un-reasonable to minimally assume a 40-year operational period for the HAMP Regional Water System Plan, but the well-head As treatment alternative will have been replaced two or three times before reaching a 40-year service life.

a. Discount Rate: To adjust the previous discount rate to the current 0.5% value is a major planning-process readjustment. The necessity and value for doing so must first be discussed further by the joint agency planning team personnel.

b. Cost escalation: The necessity and value for developing separate calculations with and without the 1.8% escalation factor will be discussed further by the joint agency planning team personnel.

c. Renewal & replacement cost: A fairly thorough accounting of R&R costing is presented in the August 2014 HAMP Strategic Plan.

d. Salvage Value: In Section 5.1 on page 31 of the LCCA (HAMP Present Value Analysis) it states that "…*Estimated salvage value is not included, but a remaining useful life value is determined to identify assets that have useful life and value at the end of the 20 year design life. This is based on the assumption that the selected water system will continue to serve the Villages for some time after 20 years, rather than being abandoned."* In fact, *"the selected water system"* will need to serve the First and Second mesa Hopi Villages for much longer than 20-years. That is why it is quite important to acknowledge that the Turquoise Trail Wells have been constructed to a very high standard in order that they do last for at least 40-years and very likely longer. Similarly, the WSTs and transmission piping which has been proposed for the HAMP regional water system plan is being designed for similar useful service-life durations. (see IHS note for 8. above)

e. Sunken Costs: The joint agency response team has always considered sunken costs to be independent of the project funding proposal and request process. There are numerous existing infrastructure elements in each of the villages that will be utilized as supplemental or accessory components to the HAMP regional water system or to a well-head As-treatment alternative. The costs of those facilities were addressed through

alternative funding processes at various points in time, just as the most recent sunken cost infrastructure has been funded over a period of 0-7 years outside of the USDA-RD funding assistance process. The necessity and value for developing separate calculations with and without the inclusion of sunken costs will be discussed further by the joint agency planning team personnel.

f. LCCA Overall: The LCCA is quite descriptive in the way that it develops and describes the process which was utilized to calculate its present value results. The necessity and value breaking-out separate spreadsheet files and calculatins from the overall LCCA will be discussed further by the joint agency planning team personnel.

g. Non-Monetary Selection: The primary "Non-Monetary Selection" criteria that is noted relates to the HAMP regional water system power supply for well operations. During the time that the LCCA and the PER were being prepared, there was still doubt regarding how the HAMP Turquoise Trail Wells would be energized, i.e. by grid-power or by on-site diesel-powered generators. As stated in Section 3., on page 6 of this document, the issue of electrical grid-power extension to the HAMP Turquoise Trail Wells has since been resolved. There is no longer a need to consider diesel-powered generators as a power option or as a Non-Monetary Selection factor.

Table 5.3 – Non-Cost Rating and Comparison

Criteria	HAMP	Arsenic Treatment
Complexity	Low	High
Operator skills required	Low	High
Reliability (grid/generator)	High/Medium	Medium
Sustainability (grid/generator)	High/Medium	Medium
Regulatory compliance	High	Low
Safety & Security	Medium	Medium

9. Section 8.0, Proposed Project: (***joint-agency response***)

   a. Section 8.3, USDA RUS Loan and Grant Requirements: This is clearly understood.

   b. Section 8.7 Estimated HAMP Costs:

      i. Current rates, revenue and operating budget within the PER for three existing systems to be served are for water and sewer combined, etc.

      ii. Income (FOR THE WHOLE SYSTEM)

- etc.
- etc.

iii. Annual O&M Costs AFTER CONSTRUCTION. (FOR THE WHOLE SYSTEM)

- etc.
- etc.

iv. Debt Repayments.

- etc.
- etc.

v. Debt Service Reserves.

- etc.
- etc.

vi. Short-Lived Asset Reserve (FOR THE WHOLE SYSTEM)

- etc.
- etc.

Section 9.b.i – 9.b.vi will involve administrative and clerical work to be conducted by different members of the joint agency review team. The work will need to be provided as a separate submittal from the HAMP PER as permitted.

10. Section 9.0, Conclusions and Recommendations: (***joint-agency response***) Unfortunately, the requirement for First and Second Mesa Hopi Villages to comply with the SDWA MCL of 10 ppb for As is a non-negotiable issue. That fact negates historical and/or continued reliance on artificially suppressed water utility fees which may have averaged $17.00 per month in 2013 but which have steadily climbed to a current, but still suppressed though rising, average value of $28.66 per month. At current billing rates, none of the Hopi Village water systems are self-supporting through revenue from water and wastewater utility system customer fees. That is why commonly required spare parts are often not available and why control systems such as pressure reducing valves and altitude valves are not operable such that they must be isolated or bypassed and operated manually.

It is useful to differentiate between the price of a commodity and the actual cost of the same commodity. Within the water billing structures of each Eastern Arizona tribal utility organization it can be demonstrated that price does not equal actual cost. In reality, the price of piped water from eastern Arizona tribal utility systems is frequently less than one-half of the true cost to deliver piped water to a residential faucet.

When a utility sells its products and services for a lesser price than the actual true cost of those products and services, one of two results will generally occur.

a. A subsidy must be applied to offset the cost-deficit so that bills, payroll, etc. can be paid for, or

b. The cost of operations must be reduced by deferring proper and critical maintenance tasks in order to compensate for the cost deficit.

In the case of Hopi Villages, Hopi tribal funding, which is allocated annually to all villages except for the FMCV, is often used to subsidize the expense of utility system operations.

The IHS has been working with the Hopi Tribe and the USEPA-R9 to design and build water systems in Hopi Villages for more than 50-years. Based on that experience, the HUC (Hopi Tribe), the USEPA-R9 and the IHS are confident in the knowledge of which systems will function over the long-term on the remote Hopi Reservation.

The minimization of capitol cost as a trade-off for complex operational needs, reduced system reliability, and short-term performance results is false economy. Investment in the long-term sustainment of communities where people have lived for many hundreds of years and where they will continue to live for many more years into the future provides true economic value.

Well-head As-treatment facilities will work just fine until they don't. When equipment of that type is new and shiny, a lesser-skilled operator can produce SDWA As-MCL compliant water with minimal difficulty. However, when equipment ages, and when pumps fail, and when instrumentation requires re-calibration and then becomes obsolete, and when media-beds must be replaced with expensive proprietary material and old media must be contained then disposed of as a hazardous waste, the true cost of well-head As-treatment operations will become more readily apparent. Unfortunately, by that time there will be no project grant funds remaining, just the monthly payments due on a 40-year loan.

To categorize the HAMP regional water system plan as not being modest in size, design, and cost is not accurate when the expanse and variety of its service area is considered. The HAMP will serve a minimum of four (4) villages with safe potable water for the next 40+

years. In the interim, residents of those communities must purchase bottled water or drink water that is contaminated with As.

A listing of USDA-RD Arizona Tribal Communities Projects is presented in the USDA-Rural Development Five Year Report for 2011-2016. That list illustrates a potential for grant projects that exceed $4M in budget that appear to have no loan component. Thus, perhaps it is possible to define "modest in size, design, and cost" on a project-by-project basis.

The monthly cost of water is rising everywhere. It is also true that the economy and household income levels in Second Mesa will require people to pay more for their water than they want to. In some instances, payment of the monthly water bill will be a difficult burden against limited household income. These issues which can be addressed to some degree at the tribal and village level, but reality dictates that people will have to pay more to receive water that meets the SDWA standard for health and potability.

These considerations are not valid reasons to be less than conservative with project cost estimates and HAMP O&M budgetary projections. To date, conservative planning and design has been an important part of the HAMP regional water system development process and it should continue to remain as such until the project is complete and operational.